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THE DISENGAGEMENT SYSTEM OF THE WARHEAD(U) FOREIGN  
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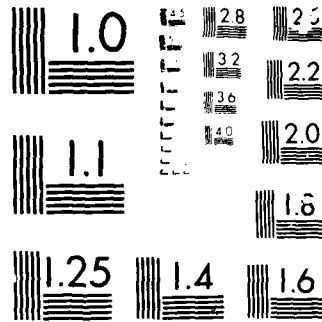
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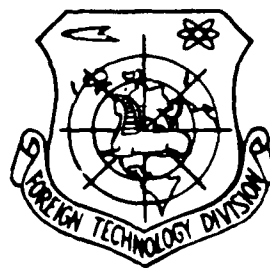


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THE DISENGAGEMENT SYSTEM OF THE WARHEAD

by

W. Linsen



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## HUMAN TRANSLATION

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THE DISENGAGEMENT SYSTEM OF THE WARHEAD

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## THE DISENGAGEMENT SYSTEM OF THE WARHEAD

Wang Linsen

Warhead herein implies the combat portion of a ballistic guided missile. For tactic guided missiles with a range of several hundred kilometers, the warhead generally hits the target together with the missile body and then detonates. However, for strategic guided missiles with a range over 1,000 kilometers, their warheads are attached to the missile body by connecting components such as an explosion hatch, an explosion lock, anchoring pins and other fast-release connectors. In order to satisfy the demand for range and re-entry into the atmosphere, at a certain instant during the guided missile's flight, the rocket engine is turned off, and the connecting components are blown away, thereby separating the warhead and missile body. The warhead then, following its inertia ballistics, flies independently toward the target.

There is a controlled and reliable device on the missile for separating the warhead. This is a specialized system, i.e., the warhead disengagement system. Based on the difference in location and direction of the separating forces, the system can be categorized into three types: ejection, maneuvering and combination.

### Warhead Ejection Device

In order for the warhead to quickly disengage from the missile body at a certain instant during flight and to maintain the warhead's

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preset flight orbit, there are different types of ejection mechanisms. At present, the pneumatic, explosive and spring are the three kinds commonly used.

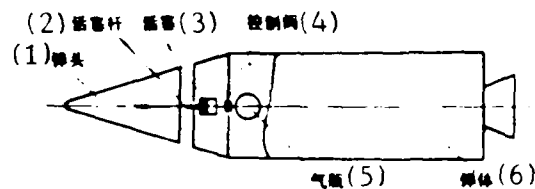


Fig. 1.

Key: (1) warhead; (2) piston rod; (3) piston; (4) control valve; (5) gas drum; (6) missile body.

**Pneumatic Ejection Mechanism.** It uses compressed gas (e.g., nitrogen, helium, air, etc.) as the ejection force. Generally, it is installed at the center of the disengagement plane which should be as close to the axis of the missile body as possible. It is primarily composed of a piston rod, piston cylinder, control valve, compressed gas drum (or propellant storage tank), and ductworks for delivering gas, etc. As shown in Fig. 1, the gas supply is provided by the compressed gas drum. During the flight period of the guided missile, the control system gives a "disengagement" instruction to the control valve causing it to open automatically. Thus, the ductworks are all clear causing the piston rod in the piston cylinder to shoot out of the opposite side. From the force of impact by the piston rod, the warhead quickly separates a certain distance the moment the connecting components are released. The operation of this ejection mechanism is simple, safer and more reliable. However, due to additional separating forces imposed on the warhead as it is being ejected, the distribution accuracy of the warhead's point of impact is affected to a certain degree.

**Explosive Ejection Mechanism.** Its structural principle is similar to that of the pneumatic mechanism except that its ejection force is provided by the combustion gas generated from the combustion

of specially made small explosive sticks. Its structure is more compact, and therefore beneficial to reducing the weight and increasing the range of guided missiles.

The explosive ejection mechanism generally includes components such as explosive sticks, ignitor, piston, piston rod and piston cylinder, etc. When the ignitor is agitated to ignite, the explosive sticks start to burn, generating combustion gas that operates between the enclosed piston and piston cylinder. Since the piston cylinder is fastened on the missile body, the piston is therefore pushed violently in the direction of the warhead.

Generally, the combustion speed of the explosive sticks relates to the explosive temperature. The explosive temperature varies causing the pressure of the explosive combustion gas to fluctuate, and thus the ejection force cannot be maintained at a steady value.

Spring Ejection Mechanism. It generally consists of components such as spring, anchoring pins, cylinder, etc. It can be singly installed at the center of the missile body front end. It can also be evenly distributed along the circumference of the connecting frame between the warhead and missile body. Figure 2 shows the multiple installation.

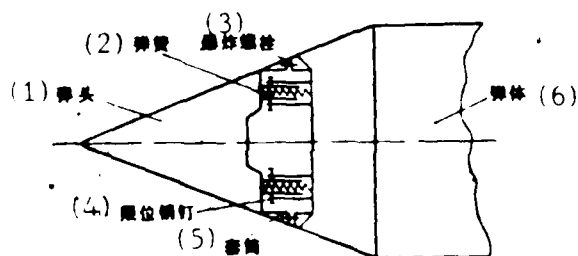


Fig. 2.

Key: (1) warhead; (2) spring; (3) explosion bolt; (4) anchoring pin; (5) cylinder; (6) missile body.

The spring of the ejection mechanism is in a compressed state when the warhead and missile body are joined. The moment the explosion bolt is severed, the warhead, under the tensile effects of the spring,



is ejected from the missile body in a short instant. When multiple installation is adopted, each spring must have equal tensile strength and its action synchronized. Although this ejection mechanism is relatively simple, its technical requirements are more stringent.

#### Missile Body Maneuvering Device

The missile body maneuvering device is a device using the reverse air jet exhausted from the warhead connector at the missile body front end that reduces the flight speed of the missile body. Major types are: to install maneuver rockets on missile body; to utilize the propellant storage tank or the residual compressed gas from the pressurization system; to utilize exhaust gas from the main engine. A disengagement system of this kind does not exert additional forces and acceleration on the warhead; it merely reduces the speed of the missile body. Thus, the disengagement accuracy is higher.

Maneuver Rockets. They are essentially solid-fuel rockets. Based upon the demands for the selected disengagement timing and forces, generally a smaller amount of solid propellant is filled. As a result, the rocket's dimensions are smaller; it weighs less and its operation time is short. The rockets are usually activated as the engine is choked and its propulsion decreases. Several maneuver rockets can be installed simultaneously on the missile body. They can be installed at the front portion of the missile body; they can also be installed at the center portion or rear portion of the missile body. These rockets must be installed parallel to the axis of the missile body. A certain distance between the warhead and missile body, as shown in Fig. 3, must be guaranteed when they disengage to avoid the danger of collision.

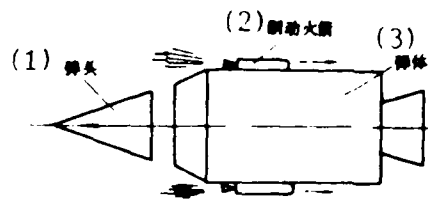


Fig. 3.

Key: (1) warhead; (2) maneuver rocket; (3) missile body.

Apparently, the activation of several maneuver rockets must be coordinated. The installation angles must be accurate, otherwise greater interference will result and affect the disengagement accuracy.

**Pneumatic Mechanism for Missile Body Maneuver.** This structure is very simple. It uses propellant or residual pressure in the pressurization system to maneuver and decrease the speed of the missile body. This mechanism merely requires that several gas nozzles with plugs be installed on the propellant storage tank or at the front portion of the gas drum. At the moment the warhead needs to be disengaged, the plugs at the nozzles are automatically thrown out causing gas to shoot out of the front end of the warhead and thereby producing the reactional forces for maneuvering the missile body.

**Maneuver by Main Engine Combustion Gas.** This is a common missile body maneuvering method for solid-fuel guided missiles. Several openings are made at the front end of the main engine combustion chamber, and they are sealed by lids. At the moment of disengagement, the lids are opened and the combustion gas shoots out in the direction opposite to the flight of the guided missile. This mechanism can be used not only to turn the main engine off, but also to disengage the warhead from the missile body.

#### Combined Disengagement Device

To disengage the warhead in a timely, precise, fast and reliable manner is one of the critical ways for increasing accuracy of ballis-

tic guided missiles, and the combined disengagement device is such a technical measure taken in order to satisfy such a need. It does not simply combine the ejection device and maneuvering device together and then put it to use. Moreover, it exerts a force at the point where the warhead and missile body join to cause the warhead to move in the normal or lateral direction. Thus, the warhead's original flight ballistics are changed.

The maneuvering rockets on the missile body must be installed at an angle to the longitudinal axis of the missile body so as to cause the missile body to rotate around its center of mass. Thus, even if the missile body, under after effects, might catch up with the warhead, collision will not occur. If other reverse gas flow devices are adopted, the same operation principle also applies.

The reliability and accuracy of the disengagement system is all the more important for the disengagement of the MIRV carrier and the missile body as well as the staggered release of the individual warhead during the carrier's flight toward targets. Here both ejection and maneuvering techniques are at issue. Timing, location, and speed of disengagement all demand higher precision in order to reduce as much deviation from the point of impact caused by disengagement as possible.

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